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Three-dimensional modelling of comet 67P layering: from geological sections to the exploration of impact dynamics.

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ESA's Rosetta spacecraft imaged bilobate comet 67P/Churyumov-Gerasimenko with unprecedented resolution, revealing a strikingly complex surface morphology, rich of geological features. Among these, ordered sets of terraces revealed that each lobe of the comet has an onion-like structure characterized by an independent concentric layering.
We here show how the development of a comprehensive understanding of the layers geometry benefited from the realization of progressively refined 3D models, from the first geological cross sections to highly adaptive implicit modelling, passing through idealized models based on analytical shapes. We will describe these methods and discuss how each of these modelling strategies contributed to the understanding of previously unexplored features of cometary bodies. Three-dimensional modelling not only made it possible to reproduce geological structures analysing their features, but provided insights on the material rheology and the mechanisms that were at play when the two lobes merged giving birth to the current comet configuration. These observations provide precious information that will prove fundamental in designing a new collision model based on Discrete Elements Method (DEM) that will be used for exploring the kinematics of impacts between cometesimals.